UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/893,866	06/28/2001	Apostolos Voutsas	SLA 0592	5636

29397 7590 01/15/2003

LAW OFFICE OF GERALD MALISZEWSKI
11440 WEST BERNARDO COURT
SUITE 157
SAN DIEGO, CA 92127

EXAMINER
SARKAR, ASOK K

ART UNIT	PAPER NUMBER
2829	

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 12

Application Number: 09/893,866
Filing Date: June 28, 2001
Appellant(s): VOUTSAS, APOSTOLOS

Gerard W. Maliszewski
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/4/2002.

(1) Real Party in Int rest

A statement identifying the real party in interest is contained in the brief.

(2) R lated App als and Interferenc s

A statement identifying the related appeals and interferences, which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The amendment after final rejection filed on 9/19/2002 has not been entered.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 1 – 11 and 12 - 23 stand or fall together because appellant's brief states so (page 4).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct, ***except that claims 24-25 are not pending and should not be considered.*** These claims were first presented in the after final amendment, which is not entered.

(9) Prior Art of Record

5,569,936	Zhang	10-1996
6,306,694	Yamazaki	10-2001

Admitted Prior Art, Specification in page 4, line 5.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1 – 3, 12, 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang, US 5,569,936. (This rejection is set forth in prior Office Action, Paper No. 6).

Zhang teaches a method of fabricating LCD device comprising:

- forming a target including silicon and a first concentration of first impurity (in column 3, lines 60 – 65) of transition metals such as Ni (in column 3, lines 50 – 53)
- supplying a substrate 10 with reference to Fig. 1.
- sputter depositing an amorphous Si film on the substrate with a controlled amount of second concentration of the impurity.

2. Claims 4, 5, 11, 13, 15, 16 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936. (This rejection is set forth in prior Office Action, Paper No. 6).

Zhang teaches forming the amorphous silicon film from a composite target of Si and impurity Ni having concentration of 10^{17} atoms/cm^3 in between column 3, line 46 and column 4, line 17.

Zhang fails to expressly teach forming the Si target with single crystal silicon and first Ni concentration of 0.01 – 0.5 atom% and then depositing an amorphous Si film containing a second Ni concentration.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to form the amorphous film with a second Ni concentration from a composite target of single crystal silicon and first Ni concentration of 0.01 – 0.5 atom% since amorphous Si will be produced by sputtering from any type of Si target so long as the substrate temperature is not too high to crystallize it. Moreover, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control these parameters during the crystallization of an amorphous silicon film to form the TFT of appropriate performance characteristics through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

Note that the specification contains no disclosure of either the critical nature of the claimed processes or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen methods or upon another variable recited in a claim, the Applicant must show that the chosen methods or variables are critical (*Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir., 1990)). See also *In re Aller, Lacey and Hall* (10 USPQ 233 – 237).

3. Claims 6, 8, 9, 19, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936 in view of Yamazaki, US 6,306,694. (This rejection is set forth in prior Office Action, Paper No. 6).

Zhang teaches a method of crystallizing amorphous Si film by sputter deposition from a composite target of Si and transition metal.

Zhang fails to expressly teach adding a third concentration of P in the target to deposit the Si film with a fourth concentration of P sufficient to create a V_{th} shift (threshold voltage) in the Si film (claims 6 and 19). Zhang also fails to add a first concentration of Ge to the composite sputtering target of Si to form amorphous Si film containing second concentration of Ge in the film (claims 8, 9, 21 and 22) and then adding a fourth concentration of P in the composite target to control the threshold voltage of the Si film (claims 9 and 22).

Yamazaki teaches that besides Ni, Ge can also be used as a crystallization catalyst for amorphous Si in column 7, lines 37 – 42. Yamazaki further teaches channel doping with n-type dopants such as P in column 4, lines 13 – 33 for controlling threshold voltage.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Zhang's teaching to form the amorphous film with a second Ni concentration and P concentration from a composite target of silicon and first Ni concentration and third concentration of P or amorphous film with a second Ge concentration and appropriate P concentration from a composite target of silicon and first Ge concentration and third concentration of P as taught by Yamazaki, since amorphous Si can be crystallized by adding Ge catalyst and presence of appropriate amount of P within the Si film will create the first V_{th} shift for the TFT device. Moreover, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control these parameters during the crystallization of an amorphous silicon film to form the TFT of appropriate performance characteristics

through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

4. Claims 7, 10, 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936 in view of Yamazaki, US 6,306,694 as applied to claims 1, 3, 12 and 16 above, and further in view of the Admitted prior Art (APA). (This rejection is set forth in prior Office Action, Paper No. 6).

Regarding claims 7 and 20, Zhang in view of Yamazaki teaches about sputtering, but fails to expressly teach pulsed or non-pulsed DC sputtering.

The APA teaches DC sputtering in page 5, line 4.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Zhang's teaching to form the amorphous film by pulsed or non-pulsed DC sputtering from a composite Si target since pulsed DC sputtering is a common method of sputtering semi-insulating materials.

Regarding claims 10 and 23, the APA teaches forming the impurity silicide by annealing in page 2, lines 1 – 5 by low and high temperature annealing.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention that crystallization of Zhang's film will occur through the intermediate formation of Ni-silicide during the annealing process.

(11) Response to Argument

Sputtering is a film deposition process that has been known for over 30 years. In this process, a target is connected to a negative voltage supply (DC or RF) in a vacuum chamber. The target is a plate of material to be deposited as a film or the material from

which a film is to be synthesized. An inert gas such as argon is used to bombard the target to dislodge the target material and eject that material from the surface of the target. The substrate upon which the film is to be formed faces the target. The material ejected from the target coalesces on the substrate and forms the film.

The most striking characteristic of the sputtering process is its universality, since virtually any material can be used for coating. The sputter coating technology includes many variation of the basic process such as sputtering from a composite target made of several materials. For any single material, the sputtering process is quantified in terms of sputtering yield. Sputtering yield expresses how much of each of the target materials is transferred from the target to the film. This yield is different for different materials. Therefore, the composition of the film made by sputtering from a composite target is generally different from the composition of the target. Sputtering has been used as an industrial process for formation of films of materials since the 1970s. It is old and widely used.

Appellant's first argument (p 5, # 1) is that Zhang does not teach the steps of forming a silicon target with first concentration of impurities. Appellant then states that no mention is made of the concentration of impurities to be added. This argument is not persuasive. Zhang teaches catalyst (i.e. impurity) can be added in the target material for sputtering, "in the case of forming amorphous silicon film by a gas phase method like sputtering, these catalysts can be added in a deposition material like target or deposition source" (col. 3, ln. 62 – 65). Zhang teaches the target is Si because he teaches depositing an amorphous silicon film by sputtering. One of ordinary skill knows

that to deposit a Si film by sputtering, the target has to be Si. Therefore, Zhang, by stating in col. 3, ln. 62 – 65, "in the case of forming amorphous silicon film by a gas phase method like sputtering, these catalysts can be added in a deposition material like target or deposition source", teaches forming the Si target and adding catalyst to the target, i. e., adding the impurities. Existence of concentration of impurities in the target is inherent because Zhang is preparing the film containing these impurities coming from the target as a result of sputtering. Therefore, the target, inherently, has some concentration of impurities and the film also has some concentration of impurities.

Appellant's second argument (p 5, # 2) is that Zhang does not enable use of Si target because he forms his film by CVD and he does not use a Si target in embodiments I – IV. This argument is not persuasive. As mentioned above, Zhang clearly and explicitly states in col. 3, ln. 62 – 65, that sputtering from Si to form a silicon film is known. One of ordinary skill understands from col. 3, ln. 62 – 65, of Zhang that Si target and impurities are used. Therefore, Zhang clearly teaches even if embodiments I – IV do not use this method. Already Zhang teaches that it is known to one of ordinary skill that Si film can be deposited by using sputtering. He states explicitly that catalyst, i. e. impurity, is added to the target. Therefore, Zhang teaches Si target and impurity. Whether or not he actually uses Si and Impurity in embodiments I – IV does not detract from his teaching that this method is known. It is irrelevant that Zhang teaches this method in the summary and background of the invention because he clearly provides the teaching.

Appellant states that "this one-line mention of sputtering" does not enable one of ordinary skill to perform the steps. This statement is incorrect and without support. Appellant has *no support* that this one-line disclosure is not enabling. Sputtering is a well-known commercial film deposition method for over 30 years. Therefore, the one-line disclosure that states that sputtering is used will convey the steps to any one familiar with sputtering and in particular to one of ordinary skill.

Appellant's third argument (p 6, # 2) is that Zhang does not teach use of a particular concentration of impurities in the target selected to achieve a desired concentration of impurities in the resultant film. Zhang does not teach a relationship between concentration of impurities in the target and the resultant film and fails to teach forming target with single crystal silicon. First, appellant does not claim any particular concentration. The claims merely recite a first and second concentration. As mentioned above, one of ordinary skill understands from Zhang that Si target and impurities are used. Zhang teaches that it is known to one of ordinary skill that Si film can be deposited by using sputtering states explicitly that catalyst, i. e. impurity, is added to the target. Whenever some impurities are added, inherently there is a first concentration, which is all what claims 1 – 3 include. Moreover Zhang states the desired concentration of the catalyst (impurity) element in column 4, lines 5 – 6. During the sputtering process from a composite target of a Si and metal catalyst (impurity) the desired concentration of the impurity in the resultant film will be inherently different from that of the target. Therefore, one will need to adjust the target composition in order to get the desired concentration in the resultant film. This is how sputtering works and any

person with ordinary skill in the art of sputtering, which is a well-known film deposition technology for more than 30 years and is used routinely by the semiconductor device manufacturers, will know this. Further, the Applicant states this *inherent* (*emphasis added by Examiner*) sputtering property in their specification in page 8, lines 5 – 15 as stated by the Appellants in page 8, # 2 of their brief. Additionally, since Zhang teaches forming amorphous Si film with desired concentration of impurities and also varying the concentration of impurities in the film as desired (column 4, lines 1 – 6), he inherently teaches varying the impurities in the target. Otherwise, the concentration of impurities within the film could not be varied.

Appellant's fourth argument (p 6, # 3 and p 7) is that Zhang fails to teach forming the Si target with single crystal silicon and first concentration of 0.01 – 0.5 atom% and then depositing amorphous silicon with a second concentration. This limitation appears in claims 4, 5, 17 and 18. As mentioned earlier, Zhang teaches catalyst (i.e. impurity) can be added in the target material for sputtering, "in the case of forming amorphous silicon film by a gas phase method like sputtering, these catalysts can be added in a deposition material like target or deposition source" (col. 3, ln. 62 – 65). Zhang teaches Si target because he teaches depositing an amorphous silicon film by sputtering (inherently requires a Si target). Zhang also teaches forming the *Si film* having Ni concentration of 10^{17} atoms/cm^3 in column 4, line 6. As mentioned earlier, any person with ordinary skill in the art of sputtering will know the first concentration of Ni to add *in the composite Si-Ni target* in order to obtain a second concentration of 10^{17} atoms/cm^3 of Ni *in the film* through sputtering process optimization, which is what Zhang teaches.

The person of ordinary skill will know to adjust the target composition to obtain a film of desired Ni concentration in the Si film.

With respect to appellant's statement about single crystal Si in the target (claims 11, 15-19 and 21), since the purpose is to form an amorphous film from the Si target, the target material can be either polycrystalline or single crystalline or even amorphous Si, as is well known.

Appellant's next argument (p 8, # 3) is that the Examiner does not provide any reference that discusses the range of impurity concentration or controlling the relationship of the concentrations of the target and film. As was mentioned earlier, Zhang teaches the range of desired impurity concentration in the film in column 4, lines 6 and 22, the inverse relationship between impurity concentration and the crystallization temperature in between column 3, line 65 and column 4, line 3. Zhang also teaches the desired annealing temperature and time in column 4, lines 54 and 62. Therefore, a person with ordinary skill in the art will be motivated by Zhang's teachings to optimize the composition of the target depending on the desired impurity concentration in sputtered amorphous Si film and the desired crystallization temperature and time.

About controlling the concentrations, as stated earlier, inherently the concentration of the target controls the concentration of the film. Therefore, this is inherent. Moreover, appellant does not disclose any particular control, just the values of the concentrations.

Appellant's next argument (p 9, # 2) is that Bunshah does not provide an expectation of success in obtaining the second concentration of impurity in the film from

the first concentration of impurity in the target. Bunshah teaches the inherent sputtering properties known as sputtering yields, which are different for the Si and the metal impurities. A person with ordinary skill in the art will know that different sputtering yields for different materials will inherently produce film composition different from target composition. Knowing that the sputtering yields are different as Bunshah discloses, one of ordinary skill will know to adjust the target composition to obtain the desired film composition. *Furthermore, the claimed range of 0.01 to 0.5 atom% is such a large range, that minimum experimentation is required to obtain successful results.*

Appellant's argument (p 10, # 2) is that Zhang in view of Yamazaki does not teach using P and Ge in the targets. As mentioned earlier, Zhang teaches the use of metallic crystallization catalysts in the sputtering target for producing crystallizable amorphous Si film containing those catalysts elements through sputtering deposition process. Yamazaki on the other hand teaches the similar amorphous Si crystallization process with metal catalysts by known deposition technique (see Appellants p 10, # 2) and also the use of Ge catalyst. Yamazaki teaches also the use of dopants (which in semiconductor industry means elements like B, P. As etc.) to control threshold voltages. However, the Appellants allege that none of Yamazaki's 47 embodiments teaches forming amorphous Si by sputtering and only teaches forming the amorphous Si film by known techniques. As was described earlier, a person with ordinary skill in the art of film deposition will know about sputtering, which is a well-known film deposition technology for more than 30 years and is used routinely by the semiconductor device manufacturers. He will thus be motivated to modify Zhang and use Ge catalyst and P

dopant in the sputtering target since Yamazaki teaches that Ge catalyst can be used for amorphous Si crystallization and P for controlling threshold voltages for the TFT devices.

Appellants last argument (p 14, # 1) is that Zhang, in view of Yamazaki and the APA does not teach DC sputtering. As was mentioned earlier, a person with ordinary skill in the art of film deposition will know about sputtering, which is a well-known film deposition technology for more than 30 years and is used routinely by the semiconductor device manufacturers. Among the various sputtering techniques developed over the years, DC sputtering is one of the earliest forms of sputtering techniques.

For the above reasons, it is believed that the rejections should be sustained.

KAMAND CUNEO
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Respectfully submitted,

Asok K. Sarkar
January 2, 2003

Conferees:
Kamand Cuneo

Olik Chaudhuri OC

David C. Ripma
Patent C2ounsel
Sharp Laboratories of America, Inc.
5750 NW Pacific Rim Boulevard
Camas, WA 98607